

# PATENT SPECIFICATION

820,153

NO DRAWINGS.

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## COMPLETE SPECIFICATION.

### Improvements in the Manufacture of Heat Exchangers.

We, LAWRENCE HOLDINGS (OVERSEAS) LIMITED, a British Company, of 142 Sloane Street, Chelsea, London, S.W.1, formerly of 9 Angel Court, in the City of London, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to the manufacture of heat exchangers.

Although the invention is applicable to the manufacture of heat exchangers of any appropriate kind, it is primarily the intention to apply it to a process of making heat exchangers of the general class adapted for extraction of heat from liquid in the cooling of engines and the like.

Thus, for instance, the invention may be applied to the manufacture of heat exchangers of the kind comprising, in combination, a casing or shell, a block of cooler tubes, collectively termed a "matrix" enclosed within the casing or shell and through which cooling air can flow, and baffles associated with the matrix and so arranged as to cause liquid to flow tortuously through the latter, the said casing or shell being appropriately formed for the admission and exit of liquid to and from the heat exchanger.

In this regard the invention may be applied to axial flow, radial flow or cross flow oil coolers for use in engines. Such coolers serve to augment the main cooling systems of engines by extraction of heat from the engine lubricating oil passed through the cooler.

The invention is also applicable to the manufacture of core structures of the finned tube type for embodiment in heat exchange apparatus such, for example, as radiators for use in conjunction with liquid cooled internal

combustion engines. Structures of this character usually comprise a plurality of tubes extending through spaced fins adapted to provide heat dissipating or radiating surfaces, and are alternatively known as cores of the "gilled tube" or "fin and tube" type.

Now it is a desideratum that heat exchangers shall be made of aluminium. But, in practice, it is found that normal solders used in the usual way will not bond aluminium parts together satisfactorily. Thus, for instance, a solder is prevented from wetting an aluminium surface because of the presence thereon of oxide.

Prior attempts have been made to solve this problem, but methods heretofore devised have usually failed owing to the complexity of the assembly of a heat exchanger.

The object of the present invention, therefore, is to provide a simple and efficient method of treating components of aluminium heat exchangers whereby the said components can be satisfactorily bonded together to form leak proof joints notwithstanding the use, for this purpose, of normal solders or brazing alloys.

According to this invention, a method of manufacturing an aluminium heat exchanger is characterised in that the surfaces of component parts of the heat exchanger are wholly or partly pre-coated with a vacuum plated or chemically deposited layer of a metal or alloy capable of being wetted by a solder or by a brazing alloy and then soldered or brazed together.

Any appropriate metal capable of being wetted by a solder, or by a brazing alloy, may be employed. In this regard metals or alloys such as, for example, copper, bronze, solder, tin, cadmium and silver may be mentioned.

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The step of pre-coating or plating the joint surfaces is carried out in any appropriate manner by vacuum plating or chemical deposition.

5 In any event, the technique of pre-coating or plating the surfaces to be bonded together may be carried out either before or during the assembly of a heat exchanger.

10 In the case of, say, an oil cooler of the character hereinbefore described, it would only be necessary to pre-coat or plate the end portions of the cooler tubes, prior to coating of the entire surfaces of the apertured header plates in which the ends of said tubes are secured.

15 As to a finned tube core structure, all of the tubes would require to be pre-coated or plated with a metal compatible with a normal solder or normal brazing alloy, whereas in some instances it might only be necessary to pre-coat or plate parts of the fins.

20 As will be appreciated, deposits on aluminium surfaces of a metal compatible with conventional solders and brazing alloys obviates the effects of oxidation and ensures satisfactory leak proof joints.

#### WHAT WE CLAIM IS:—

1. A method of manufacturing an aluminium heat exchanger characterised in that the surfaces of component parts of the heat exchanger are wholly or partly pre-coated with a vacuum plated or chemically deposited layer of a metal or alloy capable of being wetted by a solder or by a brazing alloy and then soldered or brazed together. 30 35

2. A method as set forth in Claim 1 wherein the end portions of cooler tubes are pre-coated with said metal or alloy prior to coating of the entire surfaces of apertured header plates in which the ends of said tubes are secured. 40

3. A method as set forth in Claim 1 or 2 wherein the heat exchanger comprises a finned tube core structure.

4. An aluminium heat exchanger when manufactured in accordance with any of the preceding claims. 45

MARKS & CLERK.

#### PROVISIONAL SPECIFICATION.

#### Improvements in the Manufacture of Heat Exchangers.

We, J. W. LAWRENCE LIMITED, a British Company, of 142 Sloane Street, Chelsea, London, S.W.1, formerly of 9 Angel Court in the City of London, do hereby declare this invention to be described in the following statement:—

55 This invention relates to the manufacture of heat exchangers.

60 Although the invention is applicable to the manufacture of heat exchangers of any appropriate kind, it is primarily the intention to apply it to a process of making heat exchangers of the general class adapted for extraction of heat from liquid in the cooling of engines and the like.

65 Thus, for instance, the invention may be applied to the manufacture of heat exchangers of the kind comprising, in combination, a casing or shell, a block of cooler tubes, collectively termed a "matrix" enclosed within the casing or shell and through which cooling air can flow, and baffles associated with the matrix and so arranged as to cause liquid to flow tortuously through the latter, the said casing or shell being appropriately formed for the admission and exit of liquid to and from the heat exchanger.

70 In this regard the invention may be applied to axial flow, radial flow or cross flow oil coolers for use in aircraft engines. Such coolers serve to augment the main cooling

systems of engines by extraction of heat from the engine lubricating oil passed through the cooler. 80

The invention is also applicable to the manufacture of core structures of the finned tube type for embodiment in heat exchange apparatus such, for example, as radiators for use in conjunction with liquid cooled internal combustion engines. Structures of this character usually comprise a plurality of tubes extending through spaced fins adapted to provide heat dissipating or radiating surfaces, and are alternatively known as cores of the "gilled tube" or "fin and tube" type. 85 90

Now it is a desideratum that heat exchangers shall be made of aluminium. But, in practice, it is found that normal solders used in the usual way will not bond aluminium parts together satisfactorily. Thus, for instance, a solder is prevented from wetting an aluminium surface because of the presence thereon of oxide. 95 100

Prior attempts have been made to solve this problem, but methods heretofore devised have usually failed owing to the complexity of the assembly of a heat exchanger.

The object of the present invention, therefore, is to provide a simple and efficient method of treating components of aluminium heat exchangers whereby the said components can be satisfactorily bonded together to form leak proof joints notwithstanding the use, 105 110

for this purpose, of normal solders and/or brazing alloys.

5 According to this invention, the surfaces of an aluminium heat exchanger to be bonded together in this way are pre-coated or plated with a metal suitable for subsequent soldering or/and brazing.

10 Any appropriate metal capable of being wetted by a solder, or of receiving a brazing alloy, may be employed. In this regard, nickel is mentioned, merely by way of example, as a possible metal.

15 Again, the step of pre-coating or plating the joint surfaces may be carried out in any appropriate manner, for instance by vacuum plating or chemical deposition, or normal plating methods.

20 In any event, the technique of pre-coating or plating the surfaces to be bonded together may be carried out either before or during the assembly of a heat exchanger.

In the case of, say, an oil cooler of the character hereinbefore described, it would

only be necessary to pre-coat or plate the end portions of the cooler tubes, although the entire surfaces of the apertured header plates in which the ends of said tubes are secured would require to be prepared in the manner described. 25

As to a finned tube core structure, all of the tubes would require to be pre-coated or plated with a metal compatible with a normal solder or/and normal brazing alloy, whereas in some instances it might only be necessary to pre-coat or plate parts of the fins. 30

As will be appreciated, deposits on aluminium surfaces of a metal compatible with conventional solders and brazing alloys obviates the effects of oxidation and ensures satisfactory leak proof joints. 35 40

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